

Structure design of X-ray interference lithography focusing mirror device

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Soft X-ray interference lithography beamline is an advanced micro and nano fabrication technology which uses two interference beams or many interference beams to expose photoresist. The main mirror chamber- focusing mirror system of the beamline is designed in this paper. Basic functions of focusing mirror system in ultra-high vacuum environment must be gained. The main mechanisms realizing the basic functions include vacuum chamber, water-cooled structure, vertical movement mechanism of the mirror body, and electric linear feed-in system. The distance between focusing mirror and ground is 1300mm.

The key mechanism-mirror precision rotating system of the beamline is discussed deeply. It is the core of the focusing mirror system, and it determines the positional and adjusting accuracy. Fixed axis rotating mechanism including rotating mechanism and linear drive structure is adopted to complete the design of mirror precision rotating system. The rotating mechanism is composed of shaft, bearings and bearing support. The linear drive structure is composed of a stepper motor and linear guide. The resolution of the stepper motor is $0.08\mu\text{m}$. The resolution of the mirror precision rotating system is tested by a laser interferometer whose type is Agilent5529A. The testing results show that the linear resolution of mirror precision rotating system is about $0.1\mu\text{m}$, and the angular resolution is about 0.25° . The testing results satisfy the design requirements.



Focusing mirror device



Rotating mechanism